

I CLAIM:

Sub A1
1. A plunger lift for a well producing through a production string communicating with a hydrocarbon formation, comprising a free piston having at least two sections, movable independently downwardly in the well, the sections being united at the bottom of the well and having an exterior seal for upward movement together in the well for pushing liquid, above the piston, upwardly.

2. The plunger lift of claim 1 wherein the piston comprises an upper section, a lower section and no other section.

3. The plunger lift of claim 1 wherein the sections nest together during upward movement in the well.

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4. The plunger lift of claim 2 wherein a first of the sections comprises a sleeve having the seal thereon and a central passage therethrough and a second of the sections comprises a mandrel having a pin receivable in the sleeve during upward movement in the well.

Sub A2/ 5. The plunger lift of claim 4 further comprising means for sealing between the first and second sections when the sections nest together.

5 4 6. The plunger lift of claim 5 wherein the first section comprises an upper section and the second section comprises a lower section, below the upper section.

6 5 7. The plunger lift of claim 6 wherein the lower section provides at least one centralizer for centering the lower section in the production string.

7 5 8. The plunger lift of claim 6 wherein the lower section provides at least two axially spaced centralizers for centering the lower section in the production string.

Sub A3/ 9. The plunger lift of claim 1 wherein a first of the sections provides a first flow bypass around the first section allowing the first section to move downwardly in the well against the flow of formation products upwardly in the well and a second section of the sections provides a restrictor for reducing the size of the first flow bypass when the first and second sections are united.

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10. The plunger lift of claim 1 wherein the sections are separated during downward movement into the well.

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11. The plunger lift of claim 1 comprising a bumper spring for positioning near the formation for engaging and cushioning impact of one of the sections at a location adjacent an end of downward movement in the well.

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12. The plunger lift of claim ⁹11 comprising a catcher for catching a first of the sections at a location adjacent an end of upward movement, in the well.

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13. The plunger lift of claim ¹⁰12 comprising means for releasing the first section from the catcher.

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~~14. The plunger lift of claim 1 comprising means for separating the sections adjacent an end of upward movement in the well.~~

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15. The plunger lift of claim ¹³14 comprising means for catching a first of the sections at a location adjacent the end of upward movement in the well and allowing a second of the sections to fall into the well.

Sub A5

16. The plunger lift of claim 1 wherein a first of the sections is an upper section and a second of the sections is a lower section, the lower section having more downwardly facing area than the upper section whereby a pressure differential across the united upper and lower sections produces a greater upward force on the lower section than on the upper section if the sections move apart.

17. In a plunger lift for lifting liquids from a well producing through a production string communicating with a hydrocarbon formation, comprising a piston having separate sections movable independently downwardly into the well.

18. The plunger lift of claim 17 wherein each of the separate sections provides a downwardly facing cross-sectional area that is insufficient to move the section upwardly in response to gas flow emitting from the formation.

Sub A6

19. The plunger lift of claim 18 wherein a first of the sections is an upper section and a second of the sections is a lower section, the lower section having more downwardly facing area than the upper section whereby a pressure differential across the united upper and lower sections produces a greater upward force on the lower section than on the upper section if the sections move apart.

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20. In a plunger lift for lifting liquids from a well producing through a production string communicating with a hydrocarbon formation and through a well head, comprising a piston and a decoupler adjacent the well head for separating the piston into separate sections thereby allowing the sections to fall separately into the well.

21. The plunger lift of claim 20 further comprising

means uniting the sections together adjacent the formation for movement together upwardly in the production string to push liquids upwardly in the well in response to gas flow into the production string from the formation;

a bumper spring inside the production string adjacent the formation for engaging the piston and cushioning impact near an end of downward piston movement;

a decoupler adjacent the well head for separating the sections of the piston in response to upward movement of the piston; and

a catcher for catching a first of the sections and means for releasing the first section in response to a signal.

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22. A multipart piston for a plunger lift comprising

an upper sleeve providing a central passage and an exterior seal assembly; and

a lower mandrel movable from a first position out of contact with the upper sleeve to a second position coupled with the sleeve and having at least one centralizer and a pin received in the passage in the second position and providing a fishing shoulder intermediate the passage.

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~~23.~~ The multipart piston of claim ~~22~~ ²³ further comprising means for sealing between the sleeve and mandrel.

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~~24.~~ The multipart piston of claim ~~22~~ ²⁴ further comprising a fishing shoulder on the upper sleeve.

25. A well head assembly for a plunger lift including a production string extending into the earth toward a hydrocarbon formation, at least one master valve on the production string, a receiver for receiving a plunger lift piston extending upwardly from the master valve, at least one wing valve in communication with the receiver and leading to a surface installation for receiving hydrocarbons from the formation, and a bypass conduit extending from above the master valve to upstream of the wing valve allowing produced products from the formation to bypass at least part of the receiver and prevent pinning the plunger lift piston in the receiver.

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23. A method of lifting liquids from a well producing hydrocarbons from a formation with a plunger lift having a multipart piston, comprising dropping parts of the piston independently in the well, uniting the parts of the piston into a unit near the formation and moving the unit upwardly in the well in response to formation gases passing into the well and thereby pushing liquid upwardly with the piston.

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24. The method of claim 23 wherein the dropping step occurs when gas is flowing upwardly in the well.

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25. The method of claim 23 wherein the well includes a well head and wherein the dropping step occurs when gas is flowing upwardly in the well and exiting through the well head.

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26. The method of claim 23 wherein the dropping step comprises dropping a first part of the piston into the well, pausing for a time period and then dropping a second part of the piston into the well.

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27. The method of claim 26 further comprising repeatedly dropping the first and second parts of the piston into the well and varying

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the time period between dropping the first part and dropping the second part.

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